

Pakistan's Agriculture Sector

Is 3 to 4 Percent Annual Growth Sustainable?

Rashid Faruquee

The World Bank
South Asia, Country Department I
Agricultural Operations Division
January 1995

WPS 1407
1407

For 25 years, agricultural growth has been a key source of the growth in Pakistan's GDP, but the momentum may be running out. Key problems include the crisis in irrigation and the government's overextended role in agriculture. An example of inappropriate government intervention is the provision of subsidies that do not help farmers, either because of rent-seeking and inefficiency or because the subsidy (for wheat, for example) helps consumers at the expense of producers. Government spending must shift to a new focus — on public goods and market failures.



Summary findings

A key source of the impressive growth in Pakistan's GDP (6 percent annually for two decades) has been the agriculture sector, which grew about 3.6 percent a year for 25 years. Faruquee analyzes whether such a growth rate is sustainable.

In different periods, growth has come from different sources: from a seed, fertilizer, and irrigation package in the 1960s, from intensification of water and fertilizer use in the 1970s, and from improvement of crop management and incentives in the 1980s. In the past 10 years, cotton has been a main source of growth.

The momentum for growth may be ending. Total cultivable land and irrigation cannot increase significantly. At best, water resources can expand by 10 percent, and only at great cost. And there have been problems with cotton in recent years.

Future growth must come mainly from increases in productivity, achieved by allocating resources to crops for which the country has a comparative advantage, improving the technical efficiency of inputs for each major crop, and increasing cropping intensity. But increasing productivity means changing major agricultural systems, policies, and institutions, including:

- Poor incentive policies, which have led to inappropriate use of land and hence to problems of soil erosion and land degradation.
- Poor distribution of land resources and inadequate systems of land tenure. At one extreme are very large estates of absentee landlords, and at the other, very small, ill-equipped peasant farms. Insecurity of tenure creates disincentives for investing in land.
- Persistent problems with irrigation, essential on more than three-fourths of agricultural land in Pakistan.
- Weak human resources and infrastructure.
- Direct government intervention in agricultural markets, which, although recently diminished, still distorts markets. Subsidized imports of wheat and price controls on cotton exports reflect a persisting bias against cotton and wheat, while sugarcane is heavily protected. The protection of domestic industry distorts sectoral prices. Government policy also distorts the market for such vital inputs as seeds and fertilizer. Serious problems in the credit market exacerbate other problems arising from policy distortions.

This paper — a product of the Agricultural Operations Division, South Asia, Country Department I — is part of a larger effort in the department to analyze the major issues facing Pakistan's agriculture sector and to suggest a strategy to improve its performance. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Fayana Willie, room MC10-346, extension 82262 (33 pages). January 1995.

The Policy Research Working Paper Series disseminates the findings of work in progress to encourage the exchange of ideas about development issues. An objective of the series is to get the findings out quickly, even if the presentations are less than fully polished. The papers carry the names of the authors and should be used and cited accordingly. The findings, interpretations, and conclusions are the authors' own and should not be attributed to the World Bank, its Executive Board of Directors, or any of its member countries.

PAKISTAN'S AGRICULTURE SECTOR

Is 3 to 4 percent Annual Growth Sustainable?

Rashid Faruquee

**Agricultural Operations Division
South Asia Region
World Bank**

Summary and Conclusions

A key source of Pakistan's impressive GDP growth (6 percent annual growth sustained for two decades) has been the agriculture sector, which grew at about 3.6% annually during last 25 years. This paper analyses whether such a growth rate sustainable in the future.

Sources of past impressive growth have been different in different periods -- seed, fertilizer and irrigation package in 1960s, intensification of water and fertilizer use in the 1970s and improvement in crop management and incentives in 1980s. In the last decade cotton has been the main source of growth.

A careful look at the sources of growth suggests that the past momentum may be running out. There is no chance of a significant increase in total cultivable land or in irrigation. At best, a 10 percent expansion in water resources can be expected, and only at a large cost. Cotton also has run into problems in recent years.

With past sources weakening, future growth will have to come predominantly from productivity growth. And overall productivity growth will come from such sources as allocation of resources to crops in which the country has a comparative advantage, improvement in technical efficiency of inputs of each major crop, and increases in cropping intensity. On all counts, Pakistan potentially can do much better than it does now. However, future growth through productivity increase will require major changes in systems, policies and institutions for agriculture.

Broadly speaking, there are two sets of constraints facing Pakistan's agriculture -- resource constraints and policy distortions. Resource constraints can be described under 4 categories. First, soil erosion and land degradation are causing problems. Inappropriate incentive policies has often led to inappropriate use of land and hence to problems of soil erosion and land degradation. Second, distribution of land resources and systems of land tenure are also constraints. Land distribution is concentrated -- at one extreme are very large, absentee landlords not optimally using land and at the other extreme are the very small and ill-equipped peasant farms. Insecurity of tenure, creating disincentives for investment in land, is another problem. Third, serious problems have plagued irrigation, which accounts for more than three-fourths of agricultural land in Pakistan. Fourth, human resources and infrastructure are comparatively weak in Pakistan.

This report is drawn from the Bank report, Pakistan: A Strategy for Sustainable Agricultural Growth (Report No. 13092 Pak). The Bank report was prepared by Rashid Faruquee with assistance from Kevin Carey. Messrs Moazam Mahmood, Nadeem Ilahi, A.R. Saleemi, Tayyeb Shabbir, Derek Byerlee, Omar Noman and Yusuf Choudhry prepared background notes and papers for the Bank report.

As for policy distortions, direct intervention by the Government in agricultural markets -- although diminished in recent years -- is still serious. Subsidized imports of wheat, duty and period restorations on cotton exports and protection of sugar cane are some of the persisting problems. Although the indirect effect of policy distortions -- causing the transfer of resources out of agriculture have come close to zero, the effect of policy in causing differential incentives within agriculture are still serious. Nominal protection coefficients reveal a continuing policy has against cotton and wheat, while sugar cane is highly protected. A major indirect intervention through policies arises from the protection of domestic industry, which penalizes agriculture through the impact on sectoral relative prices. Government policy is also affecting vital inputs -- fertilizers and seeds. Problems in the credit market are also serious.

The level and composition of public expenditure in agriculture have much to be desired. Spending is dominated by subsidies which do not help farmers either because of rent seeking and inefficiency or because the subsidy is designed to help consumers at the expense of producers (wheat subsidies).

As noted, the past growth rate can be sustained or even improved up only with major changes in systems and policies for agriculture. The changes will come with a redefinition of the role of the government in the sector and confirming it to development of a smoothly functioning market and promotion of private sector activities and market efficiency. Accordingly investment and public expenditure on agriculture will have to be reshaped and government spending will have to focus on public goods and market failures.

The key reforms needed and their suggested time frame are recorded in the attached matrix.

Pakistan: Summary and Timeframe for Structural and Policy Reforms in Agriculture

Policy Area	Objectives	Measures	Proposed Timing of Initiating Measures and Expected Implementation Period
Incentives	Market-determined output prices	*End subsidy on wheat imports	1994/95, short-run
		*Remove wheat and flour import restrictions	1994/95, short-run
		*End support prices for sugarcane	1994/95, short-run
		End support prices for all other crops	1995/96, medium- to long-run
		Initiate study into alternative means of reducing volatility of agricultural prices	1994/95, short- to medium-run
		*Build up enabling environment for private sector entry into storage and distribution	1995/96, medium-run
		Regulation of processing industry where necessary	
		*Complete trade reform	1995/96, medium-run
		Remove export taxes, import duties, and quantitative restrictions	1995/96, short- to medium-run
		Extend income and wealth tax to agriculture	1994/95, short-run
	Trade Policy reflecting comparative advantage		
	Efficient and Equitable tax system	Eliminate all agricultural tax exemptions	1994/95, short-run
		Update tax base in agriculture by revaluation of Producer Index Units	1994/95, short-run
		Installation of mechanism for periodic review of Producers Index Units	1995/96, short- to medium-run
			1995/96, short- to medium-run

Note: For implementation periods, short-run implies 1 to 2 years, medium-run, 3 to 5 years, and long-run, 5 to 7 years.

* Element of high priority

Pakistan: Summary and Timeframe for Structural and Policy Reforms in Agriculture, continued

Policy Area	Objective	Measures	Proposed Timing of Initiating Measures and Expected Implementation Period
Input Markets	Private sector production and distribution of commercial inputs	*Privatize urea production and distribution	1994/95, short-run
		Divest National Fertilizer Corporation, including plants operated by its subsidiaries	1994/95, short- to medium-run
		*Expedite privatization of phosphate imports	1994/95, short-run
		*Level playing-field between public and private sector in input markets	1995/96, short-run
		*Commercialize seed corporations	1994/95, short-run
		Privatize seed corporations	1995/96, medium-run
		Strengthen seed certification process	1994/95, medium-run
	Market-determined input prices	Remove subsidy on electricity	1995/96, medium-run
	Reform the irrigation system	*Decentralize irrigation system based on water user associations, public utilities, and market in water rights	1995/96, medium-run
		*Raise irrigation charges	1994/95, short-run
	Remove distortions in land markets and reform credit provision	Initiate a study of land reform	1994/95, short-run
		*Improvement and computerization of land records	1995/96, medium-run
		Clamp down on delinquent loans and end cheap loans for machinery purchase	1994/95, short-run
		End directed credit	1994/95, short-run

Note: For implementation periods, short-run implies 1 to 2 years, medium-run, 3 to 5 years, and long-run, 5 to 7 years.

* Element of high priority

Pakistan: Summary and Timeframe for Structural and Policy Reforms in Agriculture, continued

Policy Area	Objective	Measures	Proposed Timing of Initiating Measures and Expected Implementation Period
Government Expenditure	Reorient public expenditure towards changing needs of agriculture and enhance efficiency of expenditure program	Reduce burden of administrative expenses on research and extension budget and increase operational funding.	1995/96, short-run
		Introduce new research priorities including research on farming systems, growth-enhancing public goods, and the environment.	1994/95, short-run
		Induce private sector to undertake privately profitable research.	1994/95, short- to medium-run
		Introduce patent protection for seed varieties	1994/95, short-run
		Reduce duplication and increase coordination of research institutions to minimize wastage of resources	1995/96, short- to medium-run
		*Reduce the number of front-line extension workers and replace them with fewer, better trained workers more responsive to the needs of farming systems and not just given crops	1995/96, medium-run
		*Open consulting services by adaptive research institutes to better off farmers on a cost-sharing basis	1994/95, medium-run
		*Extensive use of mass media and other group approaches for basic messages about available technology and better farming systems.	1994/95, medium-run
		Increase investment in education, including functional education of farmers	1995/96, medium- to long-run

Note: For implementation periods, short-run implies 1 to 2 years, medium-run, 3 to 5 years, and long-run, 5 to 7 years.

* Element of high priority

Pakistan: Summary and Timeframe for Structural and Policy Reforms in Agriculture, continued

Policy Area	Objectives	Measures	Proposed Timing of Initiating Measures and Expected Implementation Period
Poverty	Rural Poverty Alleviation	Remove subsidies on capital	1994/95, short- to medium-run
		Targeting developmental expenditure towards poor and marginal farmers	1995/96, medium-run
		Develop participatory community-based organizations	1995/96, medium-run
		Ensure enforcement of tenancy protection	1995/96, short- to medium-run
Environment	Environmental protection and sustainable development	Price water at economic cost	1995/96, short- to medium-run
		Phase out sapling subsidy to encourage private sector participation in sapling market	1994/95, short- to medium-run
		Regulate pesticide use	1994/95, short-run
		Provide incentives to use Integrated Pest Management	1995/96, medium-run
		Create community institutions to manage local resources and common property	1995/96, medium- to long-run
		Encourage private and public sector investment in soil and water conservation	1995/96, short- to medium-run

Note: For implementation periods, short-run implies 1 to 2 years, medium-run, 3 to 5 years, and long-run, 5 to 7 years.

PAKISTAN'S AGRICULTURE SECTOR: IS 3 to 4 PERCENT ANNUAL GROWTH SUSTAINABLE?

A recent paper (Ahmed, 1994) has looked at the question of sustainability of the high overall economic growth rate that Pakistan attained during last two decades. A key source of the Pakistan's growth has been the agriculture sector, which grew at about 3.6% annually during last 25 years. This paper asks whether Pakistan can sustain this relatively strong agricultural growth rate.

The paper is divided into four sections reflecting different aspects of the sustainability question. Following this introduction, we briefly review the role and performance of agriculture. We argue that recent trends in output growth have been more discouraging than the 25 year averages would suggest, and that since the mid 1970s, agricultural growth has been accompanied by little or no productivity growth.

The second and third sections attempt to identify the factors that explain slow productivity growth—factors that now severely constrain agricultural growth and will continue to do so unless corrected by necessary reforms. First, we look at the resource base and show that past sources of growth (such as extension of irrigation) are running out. A major problem is that Pakistan's pattern of investment in agriculture has been flawed, with too little investment in the resource base and in raising the knowledge of farmers. Because of distorted incentives, there has arguably been too much investment in capital equipment, relative to Pakistan's comparative advantage. The paper then analyzes constraints that arise from policy failures and inappropriate government intervention and expenditures in the sector. We conclude that 3 to 4 percent annual growth rate is not sustainable with the continuation of policies and systems that are in operation now. Only with major reforms in policies and programs, can past growth rate can be sustained or even increased in the future. The fourth section outlines what reforms are needed.

I: Role and Performance of the Agriculture Sector

Role

Although the share of agriculture in the economy has been slowly decreasing (and that of industry slowly increasing), it is still the backbone of the economy, employing more than 50 percent of the labor force and earning (directly or indirectly) 70 percent of export revenues. Crops remain the most important subsector, but livestock now accounts for almost 40 percent of agricultural GDP. The agriculture sector has a direct role in determining economic growth given its one-fifth share in the economy. It has an important indirect role through purchases from other sectors and multiplier effects of agricultural income.

Pakistan is in the midst of an adjustment program, and agriculture has an important role in the process. Agricultural reforms are a major part of the liberalization program. Agriculture is essential to sustainable improvements in the internal balance, that is in the fiscal position. On the

revenue side, agriculture also has an important role to play. Tax revenues in Pakistan have been stagnant for many years at about 13-14 percent of GDP.

Agriculture also plays a key role in external balance. The current-account deficit has remained near 5 percent of GDP over the last five years and external indebtedness (as a ratio to GDP) has not improved. Strong export performance, including agricultural items, has, however stabilized the current-account deficit and improved the ability to service the debt.

Agriculture is at the center of many issues in natural resource management and environmental protection and, so, sustainable development. This is because it remains the primary user of the natural resource base: land and water.

Performance

A longer view of agriculture sector performance and past sources of growth can help assess what explains rapid growth as well as identify what sources of growth can be tapped in the future. Table 1 divides growth in agriculture into three epochs (1960s, 1970s, and 1980s-90s), with a different pattern of growth at each stage. The strong growth in the 1960s was driven by greater certainty in the use of irrigation water due to an agreement with India, a productivity enhancing fertilizer-seed package, the emergence of tubewells and electrification of rural areas, and policy changes which increased the profitability of the agriculture sector.

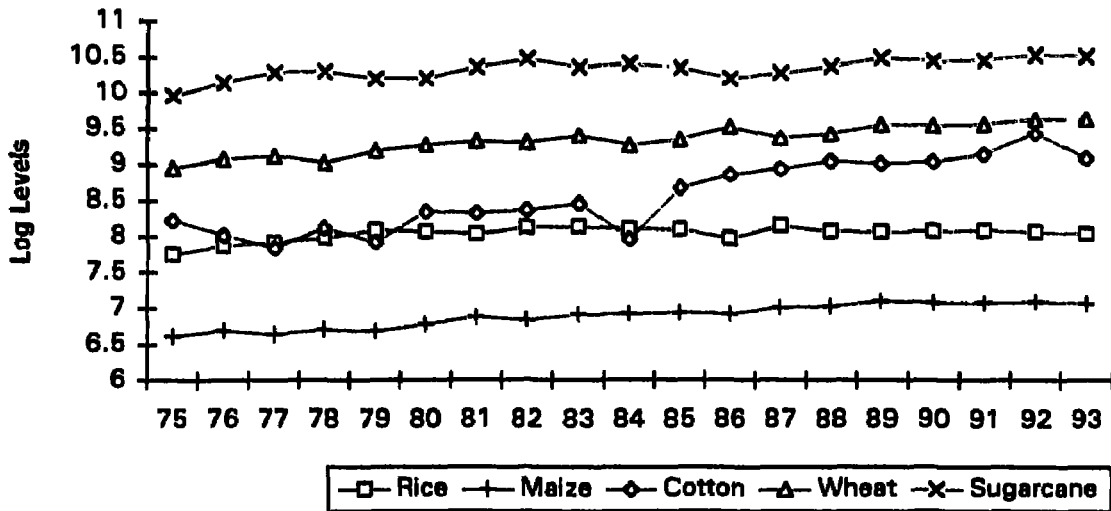
Table 1 Growth in Agriculture, 1960-1993.

Period	Average Annual Growth
1959-60 to 1969-70	4.9
1969-70 to 1979-80	2.3
1979-80 to 1987-88	3.6
1988-89 to 1993-94	3.6

Source: Economic Survey of Pakistan¹

¹ Calculations to 1988 are taken from Gross National Product at Constant Factor Cost of 1959-60, under the old National Accounts Methodology, from the Statistical Supplement to the Economic Survey of Pakistan, 1992-93. Growth is assumed to be continuously compounded. The change in the national income methodology after 1988 prevents us from presenting complete comparable figures since 1979-80. For this reason, figures are presented through to and since 1988.

Chart 1 Production of Major Crops



Source: Statistical survey of Pakistan 1992-93

Notes: Production is shown in log levels to ensure that all crops are on a comparable scale.

The significant deceleration in the 1970s was due to uncertainty created by land reforms (and their selective implementation) in 1972 and 1977, and severe climatic shocks, a cotton virus that depressed production for most of the 1970s, as well as political disruptions. The pickup from the 1970s, and the acceleration since 1988 can be attributed to the introduction of new varieties of cotton and improvements in cotton management, as well as a gradual improvement in agricultural incentives. The exceptional overall performance since 1988 (particularly the rapid growth in 1989 and 1992) was also driven by cotton, but performance is correspondingly weakened when the cotton crop is poor.

Growth in cotton production has been a dominant factor in Pakistan since the early 1980s. Cotton production nearly trebled between the year of cotton debacle (in 1984) and 1992. Growth in cotton was driven by use of quality seed, increase in pesticide use, and attractive incentives. The steady depreciation of the rupee and lower export duties contained the decline in average cotton export prices to about 12 percent between fiscal 1990 and 1992. This compares with a 29 percent decline (in \$US) in international cotton prices during this period.

Between 1989 and 1992, cotton production grew at over 10 percent per year, contributing one-half of the overall growth in the crop sector during this period, or one-third of growth in agriculture. The dependence on cotton for good growth and export performance means that Pakistan is exposed when the cotton crop suffers any setbacks. Recent developments indicate that the cotton-driven boom has now run its course and new sources of growth will have to be found in the future.

The trend in the crop sector can be seen in Chart 1, which shows the production of major crops between FY 1975 and FY 1993. The log values of production of all crops (except cotton and maize) show very little upward trend. This PAs the point is more clearly borne out by the trend of productivity growth, discussed later. Production of rice has barely increased since the early 1980s. Overall yield growth has been rather disappointing, decreasing from nearly 1750 Kg/Ha in 1982-83, to just under 1,550 Kg/Ha in 1991-92. The sluggishness in yields has been fairly uniform across varieties.

Wheat is by far the major food grain in the country. Area under wheat has slowly increased from 7.4 million hectares in 1982/83, to about 7.9 million hectares over the past three years. Wheat yields have shown some increase, from just under 1700 Kg/Ha in 1982-83 to nearly 2,000 Kg/Ha in 1991-92.

Like many other countries, Pakistan aims at self-sufficiency in sugar production which has increased slowly since the mid 1980s. Area under sugar has averaged around 0.85 million hectares over the last 10 years. Sugarcane yields have shown moderate increase, from nearly 35,700 Kg/Ha in 1982-83, to over 43,300 Kg/Ha in 1991-92.

The livestock sub-sector contributes about 37 percent of agricultural GDP. This sector has recently grown quite rapidly. Milk is the most important animal product, and 70 percent of this is accounted for by buffalo milk. About 5.5 million households own livestock, generally in small mixed farming systems.

Assessment of Performance

Growth in the past has been quite good -- over a thirty-three year period (1959-60 to 1992-93) average growth has been more than 3 percent. The aggregate agricultural growth rate in Pakistan stands up well with some other comparable countries, (see table 2). However, the nature and sources of growth raises some concerns. First, Pakistan's rapid population growth provides an additional hurdle against which its agricultural growth must be assessed. East Asian countries have maintained reasonably strong growth in agriculture with much lower population growth, allowing stronger per capita growth. For example, Indonesia's aggregate agricultural growth is about half a percentage point higher than Pakistan's, but in terms of per capita, Indonesia's growth is considerably higher (1.5% versus 0.1%). While aggregate agricultural growth in India and Egypt were lower than Pakistan, those countries did better than Pakistan in terms of per capita growth. Furthermore, Pakistan is comparatively well endowed with natural resources (arable land, water, and sunshine). With such an excellent resource base, and other favorable factors (a sizable domestic market, and favorable location) one could expect a faster rate of growth than was actually achieved. Second, recent growth performance has become unduly dependent on cotton, which leaves Pakistan vulnerable to setbacks in this crop.

Table 2: Growth of Agricultural Production and Population, 1970-91.

Country	1970-91	
	Agriculture	Population
Pakistan	3.2	3.1
Indonesia	3.6	2.1
India	2.5	2.2
Egypt	2.6	2.3

Source: World Development Report, 1993.

The concern about sustainability arises because growth has generally come from extensive, not intensive, agriculture. One way to illustrate this is to decompose the growth in output of major crops into area and yield effects. An increase in output can be broken into (1) expansion in area cropped at the old yield level, (2) an increase in yields on the old cropped area, and (3), a cross-product term representing the increase in yields on the expansion in cropped area. Such a decomposition is presented by Mehmood et al (1992) for the major crops in Pakistan for selected periods (Table 3).

Table 3: Decomposition of Crop Growth into Area and Yield Effects for Selected Periods

Period	Wheat			Rice			Cotton		
	Area	Yield	Multiple	Area	Yield	Multiple	Area	Yield	Multiple
1961-67	111.4	-9.9	-1.5	44.5	46.2	9.3	45.8	39.9	14.3
1967-76	13.7	75.7	10.6	18.6	73.6	7.8	1.7	91.2	7.1
1976-89	40.0	47.3	12.7	78.5	16.5	5.0	19.1	58.4	22.5

Note: The decomposition is constructed as follows. Let Q be output, A be area, and Y be yield. Then identically, $Q \equiv A.Y$. The change in output between any two years t and u , $t > u$, is $\Delta Q \equiv Q_t - Q_u$ and can be broken down as $\Delta Q = Y_u \Delta A + A_u \Delta Y + \Delta Y \Delta A$. The effects sum to 100 for each crop in each period. As an example, for wheat in the period 1961-67, area expansion at old yield levels account for more than total output growth. This is because yields actually fell, subtracting from the contribution of area expansion.

The three periods are chosen to capture the sources of growth before, during, and after the Green Revolution. The striking finding is the importance of area effects before and after the Green Revolution for wheat and rice; not surprisingly, during the Green Revolution, yield effects predominate. Following the Green Revolution, yield effects have remained important for cotton, for reasons explained earlier, and for wheat. The continued reliance on area expansion for growth in rice and to some extent in wheat indicates that technological progress has been slow in recent years in these key crops, a point on which we expand further in the next section.

That area expansion has been an important source of growth is evident from the low cropping intensity of 130 percent. Egypt, a country with strikingly similar resource endowments, has a cropping intensity of 180 percent. This is surely one reason why Pakistan with an agricultural land base six times as large as that of Egypt, its agricultural product was less than twice that of Egypt. Egypt does have the benefit of greater water resources than Pakistan - which highlights the need for Pakistan to use its water resources as efficiently as possible.

Productivity Growth

Production estimates by themselves do not provide sufficient information to evaluate the growth process. One needs to consider output growth relative to inputs -- that is, productivity and productivity growth.

Byerlee (1994) divides technical change in land intensive systems into four stages, distinguished by the sources of growth in each phase: (1) the pre-Green Revolution phase, when growth is driven by (irrigated) area expansion, and productivity growth is modest, (2) the Green Revolution phase, when growth is driven by high yielding varieties with increased responsiveness to inputs, (3) the first post-Green Revolution phase, when growth is driven by intensification of input use, especially chemical fertilizer, and irrigation water (which facilitates multiple cropping), and (4) the second post-Green revolution phase, when input use begins to plateau, and the source of growth becomes increases in input efficiency, coupled with the ongoing release of new varieties. According to this framework, the Green Revolution shifted the production function upwards and raised the marginal responsiveness to inputs. Farmers did not operate initially on the production frontier. In the first post-Green Revolution phase, use of complementary inputs rose, and farmers improve allocative efficiency (equalizing marginal products and prices). In the second post Green Revolution phase, farmers encountered diminishing returns to inputs, and moved towards the production frontier by raising their efficiency. Resource degradation is a form of technical regress which would shift the production function downward.

Following this framework, Pakistan is now in the second post-Green revolution phase of productivity growth, where improvements in input efficiency are the main source of growth. High yielding varieties have already diffused widely, and input use is at high levels. However, neither absolute levels of productivity, nor productivity growth over time, have matched the progress on the input side. Various methods can be used to measure productivity, but most measures yield similar conclusions.

A straightforward measure is the yield per ha. Yields have grown strongly only for cotton. Yields have grown slightly in the case of wheat and for remaining crops, yields have remained more or less stagnant. Yield figures suggest that productivity is much lower than comparable countries such as India and Egypt. For instance, in the past decade, wheat yields have grown at 1.6 percent per annum, compared to 2.9 percent in the Indian Punjab and 2.7 percent for all developing countries.

Another indicator of average productivity is yield gaps between Pakistan's farmers which are also significant. While interpretation of yield gaps is difficult, careful controlling for other factors still suggests a yield gap (measured by the difference between best and average farmers' yield) of 30 percent in the case of wheat, for instance. For rice, measures show that up to half the potential yield remained to be exploited for average farmers². These yield gaps are associated with lack of inputs when needed, insufficient water, and seed impurities.

Another indicator of productivity problem is that output is less than potential. For wheat between 1966 and 1986, Byerlee and Siddiq found that yield growth was less than would be expected from the application of green revolution inputs. They attributed this to a decline in the quality of the resource base. Indicative of resource degradation is the fact that the yield of high yielding varieties in farmers' fields has not grown since 1970, despite the intensification of fertilizer use. As with wheat, growth in yields of high-yielding varieties of rice has been disappointing. HYV rice yields grew at 0.2 percent per year between 1969 and 1981, and did not grow at all between 1981 and 1990 (Mehmood et al).

The best measure of productivity is total factor productivity, which compares an index of all outputs with an index of all inputs. Two recent studies³ find that TFP has stagnated or even declined in post-green revolution Pakistan, i.e. the period since the mid 1970s. While nearly 4 percent output growth in agriculture over the past decade might seem impressive, the TFP statistics suggest that agriculture's true contribution to economic growth is less than this. The most recent study is by Ali and Velasco (1993), who calculate total factor productivity by region and cropping system. Growth in TFP has been extremely disappointing in all the major systems (Table 4). The adverse trend is illustrated in Chart 2 for cropping systems in Punjab.

Table 4: Annual Growth Rates in Total Factor Productivity in Various Cropping Systems in Pakistan, 1970-79 and 1980-89.

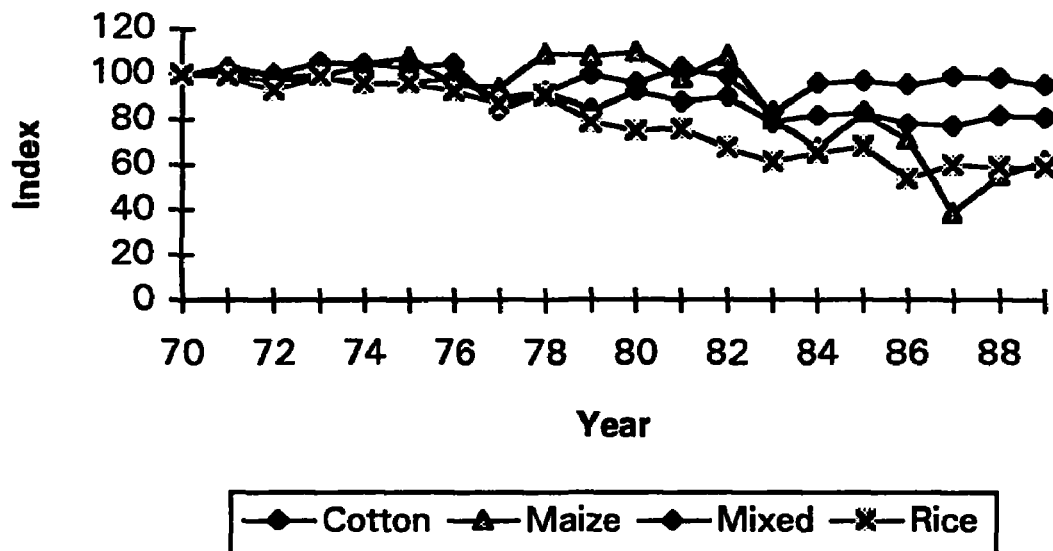
System/Region	1970-79	1980-89
Wheat-Cotton, Punjab	-0.62	0.01
Wheat-Maize, Punjab	0.42	-8.79
Wheat-Mixed, Punjab	-1.92	-1.53
Wheat-Rice, Punjab	-2.00	-2.90
All Punjab	-1.30	-0.80
All Sindh	-0.5	-1.70

Source: Ali and Velasco (1993)

² Yield gap data are taken from Byerlee (1994) and Saleemi (1994).

³ Cited in Byerlee (1994).

Chart 2: TFP in Punjab Cropping Systems



Why is the relative productivity in most crops low and why has the productivity growth been slow? There are many possible reasons. Productivity growth depends on technological progress, and it appears that once the Green Revolution technology diffused widely, further productivity gains petered out. This points to institutional problems, such as the contribution of research and extension to growth. Productivity also depends on the quality of the resource base. We show in the next section that the natural resource base (land and water) has been seriously depleted, and the quality of the human resource base is low. The functioning of input and output markets is also important; for instance input market de-regulation (especially for pesticides) is widely held to have spurred growth - which only highlights the likely cost of constraints in other areas. The present systems of seed supply and distribution of new varieties are seen as major obstacles to yield increase of some key crops (such as wheat).

Increased pressure on land will require a shift towards higher value, higher yielding crops, and higher cropping intensities. At best, an additional 10 percent expansion in water resources is available, and the cost of exploiting these resources is prohibitive. Fertilizer use is now leveling off, suggesting that returns to further intensification are falling. Future growth must rely almost entirely on efficiency gains, the potential for which is considerable.

But this will not happen simply as a result of the continuation of past practices and policies. Realization of the prospects that exist will require effective actions and policy reforms to resolve the issues and problems that now constrain the sector, particularly those impeding

productivity growth. The rest of the paper will look at these issues and constraints and suggests a future strategy for the agriculture sector.

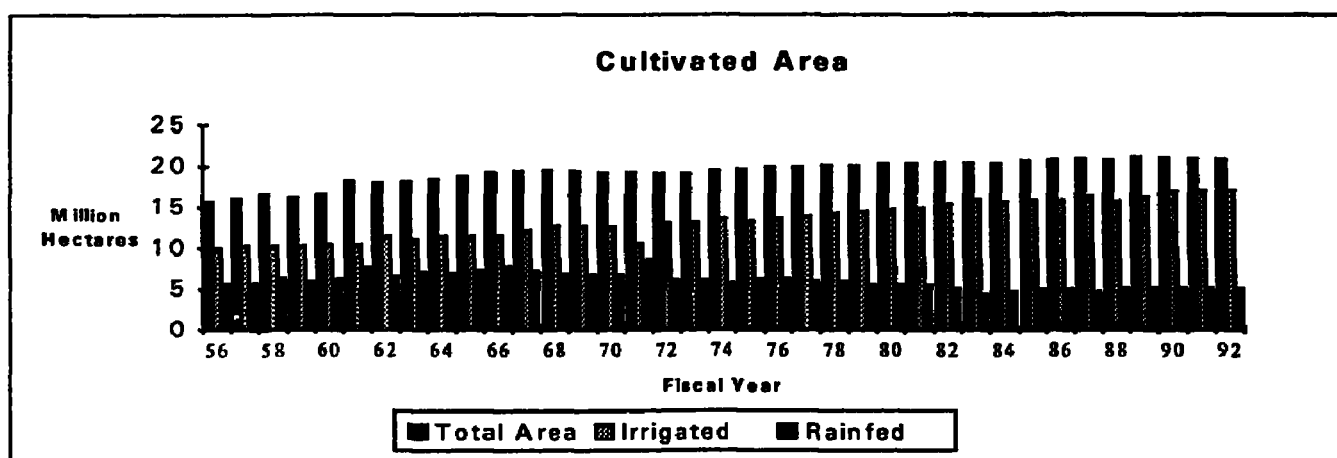
II. Issues of Resource Use, Depletion, and Development

Much of the increased agricultural output has been due to an expansion in land area cropped and liberal availability of water, but future growth cannot rely on increasing supplies of cultivable land and irrigation. Part of the past output increases have come at the expense of depletion of the resource base. Management of water resources is poor, and damage to soil resources considerable. The land available for cropping is being reduced due to waterlogging and salinity, resulting from drainage problems associated with the expansion of irrigation, and policies such as under pricing of irrigation water. Soil erosion is a serious problem. Reliance on a minimal number of crop rotations had led to a decline in soil fertility. These problems are not an inevitable consequence of agricultural growth. A different pattern of agricultural growth -- a pattern that emphasized natural resource investments -- would have done a better job of preserving the natural resource base. This section shows how natural resources have been mismanaged and how investments in physical and human capital have not taken the right form.

Land

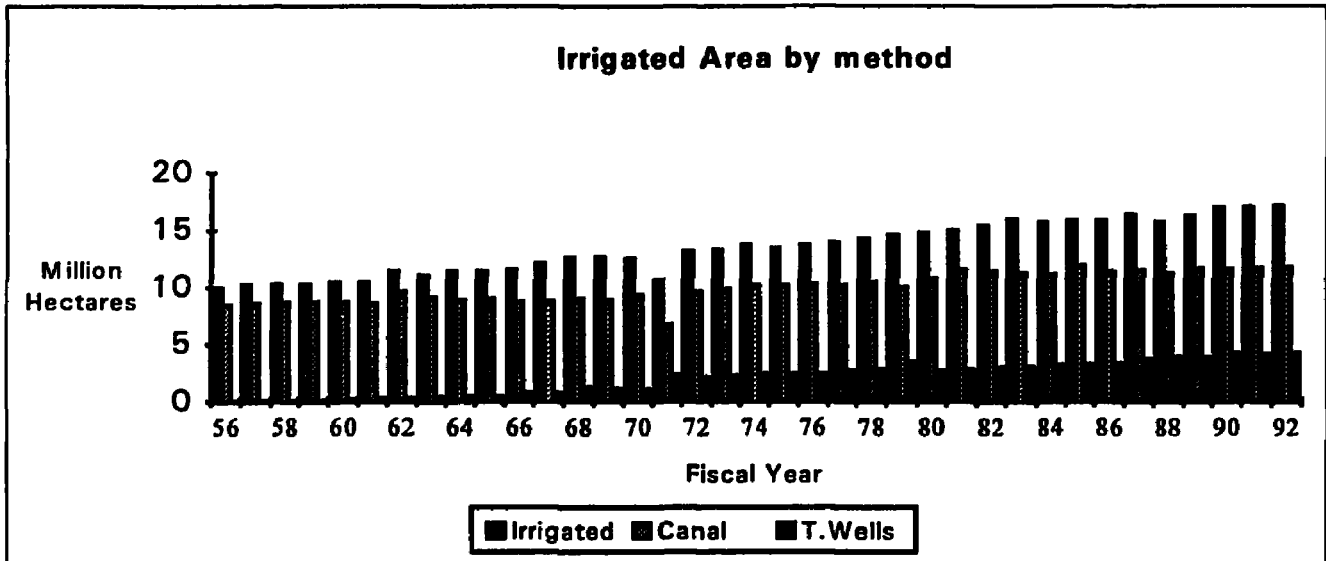
This sub-section describes Pakistan's soil resources and associated problems. Charts 3 and 4 show the long-term trends in total, irrigated, and rainfed area, and irrigated area by method (canal or tubewell).

Chart 3



Source: Statistical Survey of Pakistan

Chart 4



Source: Statistical Survey of Pakistan

Total cultivated area has been more or less constant for quite some time, and most expansion in irrigated area has occurred through reduction of rainfed area. Since the early 1980s, irrigated area has hardly expanded at all. This indicates that limits of both cultivable area and irrigated area have been reached.

A comprehensive picture of Pakistan's soil resources is available from the Soil Survey of Pakistan, carried out as part of the National Conservation Strategy in 1993. This has surveyed more than 700,000 square kilometers of land - about 80 percent of Pakistan's total area. Soils were then grouped into eight Land Capability Classes, according to their agricultural potential or relative suitability for sustained agricultural use (Table 5).

Table 5: Distribution of Land Classes by Province

Class	Punjab	Sindh	NWFP	Balo.	Pakistan	
Arable Land (percent of each class by province)					M ha	Percent of arable land
I. Very good	67	21	4	9	5.2	26
II. Good	53	33	8	6	7.0	35
III. Moderate	50	31	14	4	4.8	24
IV. Marginal	48	7	19	23	3.0	15
Forest and Rangeland (percent of each class by province)					M ha	Percent of forest/ range
V+VI. Moderate/Good	18	1	62	6	1.4	4
VI. Poor	30	6	17	43	15.4	38
VII. Unproductive	18	12	13	46	23.2	58

Note: 1. NWFP figures also include Tribal Areas

2. Pakistan figures include Northern Areas.

3. Source: Mian and Mirza (1993).

The first four classes are arable; the last four are forest or rangeland. Crucially, the land capability surveys have found that negligible additional land is available for arable agriculture. The limits of land expansion appear to have been reached.

There are several constraints on land productivity in Pakistan. These include soil erosion, problems related to irrigation, and inappropriate use of land.

Soil Erosion

Water erosion is most severe on hillsides, and along river banks. Some of the erosion is the result of long-term natural processes, but it has been accelerated by various abuses, notably the depletion of natural vegetation and excessive tillage. Over 11 million hectares are estimated to be affected by water erosion. Similar practices have also made wind erosion a serious problem, affecting about 5 million hectares. Flood damage from soil erosion is getting increasingly serious. Natural vegetation, which forms the best water absorber, has been stripped.

Meanwhile, man-made reservoirs, which should help control water flows, are impeded by sedimentation.

Irrigation-Related Problems

Salinity: Certain types of salinity cannot be blamed on the canal irrigation system and result from the mineral composition of the soil and the climate (salinity is more extensive in arid parts of the country). Canal irrigation did, however, exacerbate the problem (known as secondary salinity), notably through seepage from the canal system and subsequent evaporation; rising water tables which draw up saline groundwater; inadequate water to meet the leaching requirements of soils; insufficient attention to drainage around saline soils; and tubewells which draw on salty water.

Almost 8 percent of soil in Punjab and up to 15 percent of soil in Sindh is severely saline. While the problem does appear quite severe from the aggregate statistics, just less than 10 percent of the good quality soils are damaged. The cost of salinity in terms of lost yields is hard to evaluate. Yields have reportedly been reduced by about one-third in the case of crops grown on slightly saline areas, and moderately affected areas showed a two-thirds decrease compared with yields on normal land. Growth of any kind is difficult on highly saline soils.

Secondary salinity can be reversed with rehabilitation measures and reclamation measures have been undertaken. Application of gypsum to the soils, additional water for leaching, and drainage (under SCARPs) have all been effective in reducing salinity. Of course, these measures should always be evaluated in terms of the benefits they provide in increased yields relative to the cost of the measure. It is important to bear in mind that the returns to addressing the problem of severe salinity on marginal lands are likely to be quite low.

Waterlogging: Water-logging, too, may not be as severe as commonly believed, according to the soil survey. As with salinity, inherent characteristics of the soil can be as important a determinant of the phenomenon as human activities such as irrigation. The major cause of waterlogging in the cultivated areas is excessive percolation from the canal system, which builds up the groundwater level. Also at fault are cultivation of water-intensive crops on permeable soils, obstruction of natural drainage channels, and inefficient drainage.

The latest WAPDA figures indicates that, on average, about 2 million hectares out of a surveyed area of 16 million hectares have a water table within 1.5 meters from the surface - the Soil Survey's definition of waterlogged soil.

Other Problems: Soil nutrients have been depleted. Some get washed away by irrigation water. Unchanged cropping patterns year after year are also to blame. Almost all soils are low in organic matter, and need continuous replenishment through nitrogen and phosphate fertilizer. Soils are also highly deficient in zinc, and adequate zinc levels are particularly important in rice production.

Inappropriate use of Soil Resources

Agricultural productivity in the future can be adversely affected if soil resources are not being used appropriately. Soil resources have been damaged by the standard fertilizer packages recommended by research institutes packages that do not take account of local conditions. Infrastructure development has also played a role -- the location of sugar mills has led to large scale cultivation of sugar on sandy soils, thus aggravating water logging problems. Much land on steep slopes has been tilled, when it is really only suitable for forest. At the same time, arable land in the Indus plains remains under irrigated forests. Efforts are made to bring marginal land under arable use, at the expense of large tracts of arable land in the Indus basin that remain under-utilized. Current incentives may not reflect long-run sustainability issues. An example is the general cultivation of Basmati rice on the well-drained loamy soils of the northern Punjab, which from a sustainability point of view are ideal for the cultivation of maize, sunflowers, groundnuts, and pulses. Basmati is grown because the climate of the region is uniquely well suited to Basmati rice, and more importantly, Basmati offers high returns. Water-intensive crops such as rice can contribute to rising water tables.

Issues of Land Holding and Land Market

The previous section described Pakistan's agricultural resource base. It is also important to analyze how resources are managed, and the resulting impact on productivity and sustainability. Of particular importance is the nature and distribution of owner and operator rights to land. (Table 6).

Over one-quarter of farms are below 1 hectare in size, which represents a huge number of marginal or near-marginal farms. These farms are unlikely to be a source of significant productivity growth. Nearly half of all farms are below 5 hectares in size, but occupy just 12 percent of total land. At the other end of the spectrum, note that 7 percent of farms account for over 40 percent of total farm area. The largest category of farms (above 60 hectares) accounts for 0.3 percent of farms but occupies over 10 percent of farm area. While we do not know the distribution of farms above 60 hectares, the average farm size within this class is 125 hectares, suggesting that this category contains some extremely large farms.

Is the distribution of rights to land affecting productivity and sustainability and if so, how? Quantifying the size-productivity relationship is difficult. A stylized fact from the empirical literature is that there is an inverse relationship between farm size and productivity. A recent survey⁴ cited a typical finding from Berry and Cline (1979). A comparison of value added per cultivated area between small (between 5 and 10 ha) and large (over 20 ha) farmers in Punjab found that small farmers were over 2.5 times as productive as large farmers. However, this was

⁴ Binswanger and Feder (1993).

based on data from the late 1960s, and the picture could have changed considerably since then. Some studies did find a positive relationship between size and productivity (Byerlee, 1984, 1986; Akhter, 1986), but this can be explained by slower diffusion of green revolution technologies to small farmers.

Table 6: Distribution of Land.

Size of Farm (ha)	As % of number	As % of Area
less than 0.5	13	1
0.5 to 1.0	14	3
1.0 to 2.0	21	8
2.0 to 3.0	16	10
3.0 to 5.0	17	17
Total Small Farms	81	39
5.0 to 10.0 (Medium)	12	21
10.0 to 20.0	5	16
20.0 to 60.0	2	14
larger than 60.0	0.3	10
Total Large Farms	7	40

Source: Census of Agriculture, 1990.

At the farm level a number of reasons for an inverse link between size and productivity (and perhaps sustainability) can be suggested. It is generally accepted that there is an inverse relationship between size of farm and *intensity of cultivation*. This relationship holds for Pakistan (Table 7). There is a clear fall-off in cultivation as size rises. This may not necessarily represent an efficiency loss, since large farms are more likely to contain uncultivable waste-land. In addition, some marginal farms are forced to use land very intensively to meet subsistence needs - something which may not be efficient from a long-run perspective. However, it is undoubtedly true that some of the largest farms represent absentee landlords and underused lands and therefore give rise to a loss of efficiency. Incentives to own land arise from the use of land as a tax-shelter, or simply as a source of status. And since land until recently has not been taxed, and irrigation charges have been low, there is little need to cultivate land to meet associated expenses. This is why large tracts of land can remain idle for long periods of time.

Table 7: Cultivated Area as Percent of Farm Area, By Size of Farm.

Size of Farm (ha)	Cultivated Area /Farm Area (%)
under 0.5	92
0.5 to 1.0	92
1.0 to 2.0	91
2.0 to 3.0	91
3.0 to 5.0	90
5.0 to 10.0	86
10.0 to 20.0	79
20.0 to 60.0	70
above 60.0	54

Source: Census of Agriculture, 1990

Controlling for intensity of cultivation, three important effects of size on productivity can be distinguished. First, small farmers have an advantage in labor supervision over larger farmers. Therefore the quality of labor input is likely to be higher on small farms. Second, however, small farmers can have restricted access to modern inputs, and this can hold back their productivity. Third, small and large farmers may differ in their attitudes to risk and uncertainty -- large farmers may be more willing and able to carry greater risks. What is the evidence on each of three expected effects of firm size on productivity?

The labor supervision issue has a number of facets. Large farmers who chose to self-cultivate will have to hire-in labor. The inability to completely supervise this labor will give rise to a principal-agent problem, more severe than that faced by small farmers, who rely more on family labor (Singh 1988). Frisvold (1994) finds significant supervision effects for plots in semi-arid India, and finds output losses from supervision constraints exceeding 10 percent on over 40 percent of plots in his sample. The alternative for large farmers is to rent out land to fixed-rent tenants or sharecroppers. However, Mahmood (1994) argues that the threat of land-to-the-tiller reforms has inhibited renting-out in Pakistan. This, coupled with cheap machinery may have favored self-cultivation, and the benefits of optimal labor supervision are likely not being realized. Landlords who rent out may also face supervision problems -- discussed this in greater detail in the section on tenancy.

As for use of modern inputs, the 1980 agricultural census showed no clear differences between small and large farmers in adoption of fertilizer and plant protection (Mahmood et al). The Green Revolution package of fertilizer and seed was scale neutral, but other yield-increasing technology may involve indivisible investments. Institutional constraints could impede access to inputs or credit for small farmers. However, tractor use and tubewell use was much higher on medium and large farms in both Punjab and Sindh in 1980. While the productivity benefits of

tractors are open to dispute, it is generally recognized that access to tubewell water raises productivity. Small farmers may thus be at a disadvantage, which can be overcome if they can rent in expensive lumpy inputs or purchase water on the open market.

A more recent data set from (Mahmood et al 1988) also reveals some important differences across classes of farmers. Farmers' education is an important influence on yield levels, controlling for other factors. Education is also related to use of commercial inputs (fertilizer and tractors). This suggests that more educated farmers have the managerial skills necessary to use these inputs, or alternatively that they have the skills to gain access to these inputs. Since commercial inputs have been subject to policy distortions in the past, even farmers who would have used the inputs equally productively may have differential ability to circumvent the constraints to obtaining these inputs.

Risk aversion could make small farmers less commercially oriented than large farmers but Rosenzweig and Binswanger found that this effect only operated at very high levels of risk in semi-arid India.

The conclusion to be drawn is similar to that of Rosenzweig and Binswanger (1993): the lower supervision and labor costs arising from the use of family labor on small farms more than outweigh the scale, capital cost, and risk diffusion advantages of bigger and wealthier farmers. However, some farms can be simply too small and resource-poor to be efficient even if all institutional constraints were removed. Evidence generally supports the view that the efficiency of the smallest, and presumably most marginal, farmers is low.

Tenancy: Tenancy can also have an important productivity impact. The length of the time horizon for owners and tenants is bound to differ, giving rise to differing attitudes towards long term investments (especially natural resource management investments), and crops with long gestation lags. These effects are likely to be particularly strong for Pakistan's sizable number of tenants-at-will, who can be evicted at any time, except during the cropping season. Insecurity of tenure also causes a bias towards the opening of new land (an unpriced resource), even if such land is marginal land.

In addition, different types of tenancy may have different incentive effects. Since sharecroppers only receive half of the additional output arising from extra effort, they may have weaker incentives than fixed-rent tenants. In this regard, landlord supervision and cost-sharing can overcome the disincentive effect of sharecropping. More generally, landlord supervision can overcome the problem of differing time-horizons between owner and tenant. However, supervision is a costly activity, and may not be undertaken at all by absentee landlords.

In practice, tenant farming has been in steep decline in Pakistan since the 1960s. Between 1960 and 1980 the number of tenants declined from 2 million to 1.1 million. Mahmood (1994) finds that this decline continued through the 1980s, with an increasing tendency to self-cultivate amongst larger farmers. In addition to the decline of tenancy, the composition of tenants by contract type is a major issue. Over 90 percent of rental area is share-cropped out rather than being at a fixed rental. A fixed-rental land market has failed to emerge in traditional

tractors are open to dispute, it is generally recognized that access to tubewell water raises productivity. Small farmers may thus be at a disadvantage, which can be overcome if they can rent in expensive lumpy inputs or purchase water on the open market.

A more recent data set from (Mahmood et al 1988) also reveals some important differences across classes of farmers. Farmers' education is an important influence on yield levels, controlling for other factors. Education is also related to use of commercial inputs (fertilizer and tractors). This suggests that more educated farmers have the managerial skills necessary to use these inputs, or alternatively that they have the skills to gain access to these inputs. Since commercial inputs have been subject to policy distortions in the past, even farmers who would have used the inputs equally productively may have differential ability to circumvent the constraints to obtaining these inputs.

Risk aversion could make small farmers less commercially oriented than large farmers but Rosenzweig and Binswanger found that this effect only operated at very high levels of risk in semi-arid India.

The conclusion to be drawn is similar to that of Rosenzweig and Binswanger (1993): the lower supervision and labor costs arising from the use of family labor on small farms more than outweigh the scale, capital cost, and risk diffusion advantages of bigger and wealthier farmers. However, some farms can be simply too small and resource-poor to be efficient even if all institutional constraints were removed. Evidence generally supports the view that the efficiency of the smallest, and presumably most marginal, farmers is low.

Tenancy: Tenancy can also have an important productivity impact. The length of the time horizon for owners and tenants is bound to differ, giving rise to differing attitudes towards long term investments (especially natural resource management investments), and crops with long gestation lags. These effects are likely to be particularly strong for Pakistan's sizable number of tenants-at-will, who can be evicted at any time, except during the cropping season. Insecurity of tenure also causes a bias towards the opening of new land (an unpriced resource), even if such land is marginal land.

In addition, different types of tenancy may have different incentive effects. Since sharecroppers only receive half of the additional output arising from extra effort, they may have weaker incentives than fixed-rent tenants. In this regard, landlord supervision and cost-sharing can overcome the disincentive effect of sharecropping. More generally, landlord supervision can overcome the problem of differing time-horizons between owner and tenant. However, supervision is a costly activity, and may not be undertaken at all by absentee landlords.

In practice, tenant farming has been in steep decline in Pakistan since the 1960s. Between 1960 and 1980 the number of tenants declined from 2 million to 1.1 million. Mahmood (1994) finds that this decline continued through the 1980s, with an increasing tendency to self-cultivate amongst larger farmers. In addition to the decline of tenancy, the composition of tenants by contract type is a major issue. Over 90 percent of rental area is share-cropped out rather than being at a fixed rental. A fixed-rental land market has failed to emerge in traditional

demand for crop water. The system is operated on historic canal diversion patterns, which often bear little relationship to current needs.

In response to problems with the canal system, groundwater use has risen considerably, and has been a major factor in raising agricultural production over the past 20 years. Groundwater use has been growing at 6 percent per year. Tubewells not only provide additional water, but allow flexibility to match surface water supplied with crop water requirements. Timeliness of water delivery is therefore improved, and productivity rises. But opportunities for further exploiting groundwater are limited.

Due to age, overuse, and poor maintenance, the canal irrigation system is extremely inefficient. Average delivery efficiency is 35-40 percent from the canal head to the root zone, with most losses in watercourses. Most of these losses are not recovered via tubewells. The most pressing problem is inadequate operation and maintenance. The irrigation and drainage system have been deteriorating, because of deferred maintenance and utilization beyond design capacities. In the last four years, the shortfall between required and actual O&M expenditure has averaged 25 percent.

Water charges are too low. Current charges are just 5 percent of farm income. With doubling of charges and full cost recovery, charges would still be less than 10 percent of farm income. The increased charge would amount to Rs 70 (1994 prices) per acre-foot in the field, versus a financial average return to water of Rs 700 per acre-foot (in 1994 prices), and private tubewell prices of Rs 100-400 per acre-foot (also in 1994 prices). Underpricing of water inevitably results in wasteful practices and runs counter to the goal of protecting this natural resource.

As noted earlier, waterlogging and salinity are by-products of irrigation system. In other areas, falling, and not rising, water tables are a problem. Due to explosive growth in groundwater use, there is danger of excessive lowering of water tables, and intrusion of saline water into fresh water aquifers.

The system is also characterized by inequitable distribution. Illegal pumping from canals is widespread, and in practice local water resources are often controlled by a small number of politically powerful farmers. Water does not reach users at the tail end of the system. The lack of water downstream creates an incentive to move upstream, where water is more plentiful.

Productivity and Resource Depletion

A recent study by Ali and Velasco (1993), attributes the declining total factor productivity to resource degradation. As to the causes of resource degradation, they find a clear correlation between intensification of input use across districts and resource quality. The next section will explore a variety of policy failures that can partly explain the problem. In addition to the problems outlined above, intensification can lead to problems that call into question the sustainability of a cropping system. Double-cropping affects the timing of crops in the rotation; a notable example is the often-delayed planting of wheat in wheat-cotton systems. Double-

cropping may encourage the development of insect and pest diseases specific to each system. Such problems have been found with rice-wheat and cotton-wheat systems throughout South Asia.

Modern inputs may also have been the source of problems. Tubewell water in Pakistan tends to have high sodicity, making it unsuitable for crops. Yet tubewell water has grown in importance -- partly as a result of subsidies, and partly as a result of problems with the canal irrigation system.

In general it seems that we can link growing use of chemical inputs and mechanization with resource depletion and declining total factor productivity. A major issue is why the necessary adjustments in technology, input use, and farm-management practices to arrest resource degradation have not taken place. It would seem that either agricultural prices were not signaling problems with the resource base, or that institutional failures prevented the problems from being addressed.

Human Resources

Pakistan's education levels compare unfavorably with other countries. Spending levels are also very low (table 8).⁵ Pakistan's primary enrollment is well below the expected level based on its per capita income. There is a big gender difference too: the literacy rate was 45 percent for men and just 21 percent for women. This carries a cost, even if women do not work. In the East Asian experience, educated women who did not enter the labor force were able to educate their children at home, providing substantial indirect gains to the education of women.

⁵ Education spending as a share of GDP was 2.3 percent in 1991-92, compared to a UNESCO recommended level of 4 percent. Between 1970 and 1989, real expenditure per primary pupil grew by 355 percent in Korea and 64 percent in Mexico, while growing by just 13 percent between 1970 and 1985 in Pakistan.

Table 8: Cross-country Comparison of Education Levels.

Country	GNP \$ per capita, 1990	Literacy (%)	Net Primary enrollment (%)	Children reaching 4th year
Mexico	2680	81	88	81
Egypt	600	48	91	99
Indonesia	560	77	97	89
Pakistan	380	35	29	59
China	370	73	99	86
India	350	52	66	61

Source: UNESCO and UNICEF.

Such low basic literacy and numeracy seriously inhibit agricultural productivity, and complicate the task of agricultural support services. Indeed, this could well be the binding constraint on rapid increases in agricultural productivity (and agricultural production) over the next 10 to 15 years.

A study of total factor productivity in Pakistan⁶ over 1955-85 found an important role for educational variables. Exploiting data from 35 districts over 30 years, it was found that a 10 percent increase in rural male adult literacy increased total factor productivity by 2.7 percent. This can be compared with the response to a 10 percent increase in the area under irrigation (2.4 percent), and a 10 percent increase in the share under high-yielding varieties (1.3 percent). Thus investments in education represent a potentially major source of productivity growth. The study also finds that falling investment in education can explain a significant part of the stagnation of productivity in agriculture after 1975.

Another survey in Pakistan showed that many farmers did not display basic computational needs for optimal fertilizer usage. The deficiency was strongly correlated with the availability of extension services. A study in a rice-wheat area in Pakistan found the major constraint in closing a large yield gap (40 percent) was farmers' technical knowledge and skills. There is a strong complementarity between education and the provision of extension services.

Quality of education is also a major concern. Butt (1984) found that productivity of farmers with secondary schooling (used as a proxy for quality) was significantly higher than productivity of farmers with just primary education. Primary education increased productivity 7 percent, while secondary education increased productivity by 11 percent.

⁶ Rosegrant and Evenson (1993).

Rural Infrastructure

Investment in rural areas has been a hallmark of the East Asian success story. There has been a more even balance between rural and urban public investment in roads, water, and sanitation facilities in Indonesia, Korea, and Thailand than in Pakistan. The road volume in Pakistan is one of the lowest in the world. Fewer than a third of Pakistan's 45,000 villages have access to wholesale trading centers through the network of all-weather roads. Certain areas remain cut off from the rest of the country, not only during the rainy season and in winter snows, but throughout the year.

Pakistan is poorly supplied with road length relative to both area and population. For instance, the Indian Punjab has a road density of nearly 0.5 km per square km of area, whereas for the Pakistani Punjab, the figure is just 0.3 km.

It is estimated (Qureshi 1993 b) that poorly maintained roads are raising transport costs by 30-40 percent. The distances between villages and marketing and transportation points would not pose a problem if roads were adequate, but the poor state of the rural road network severely inhibits the timely transport of inputs and outputs. Such constraints are likely to be particularly important as Pakistan seeks to improve its position in the high value foods sector - such foods often being perishable fruits and vegetables. A recent study (Besque, 1994) using a multiple regression model on Pakistani household data show that higher road status (metal paved or brick paved versus unpaved road) has a positive influence on the production of two key staples -- wheat and rice.

Pakistan faces significant energy supply constraints by comparison with other developing countries. Converting all forms of energy consumption to kilograms of oil equivalent, Pakistan's energy consumption per capita was 243 kg in 1991, below the South Asian average of 289 kg. Electricity power cuts affect the rural sector particularly badly, for up to 10 hours per day. Generators are in widespread use, but studies elsewhere have shown that the cost of power from generators exceeds that of the electricity network by many times. Many problems can be traced to Pakistan's energy sector policy, notably underpricing of energy and state control, which has led to crowding-out of public and private capital formation in the sector.

III. The Impact of Past Policy Distortions

A comprehensive review of the government's role in agriculture is available in the Pakistan agriculture sector strategy report (World Bank 1994). We concentrate here on issues that have a direct impact on the sustainability of past growth performance.

Price Distortions

In the past, Pakistan pursued a policy of holding producer prices below world prices for wheat, rice, and cotton, and the effect of price distortions on output was great. An example of the size of the losses is provided by Hamid, Nabi, and Nasim, who estimate how much (at an annual rate) actual output departed from output at free trade prices between 1984 and 1987, taking account of all interventions.⁷ Estimated short-run losses ranged from 6 percent per year for irri rice and wheat, to 10 percent per year for cotton, and 13 percent per year for Basmati rice. Of course, these results are specific to 1984-87, and some of the distortions have been mitigated or even eliminated since then. This burden was tolerable in the past when other sources of growth could counteract these disincentives. With other sources of growth now exhausted, there is a premium on "getting prices right."

Incentives in Input Market

Government policy is creating constraints in input markets. Timely availability of fertilizer is essential, but phosphate, now being imported by the public sector, is rarely delivered on time, and usually in insufficient quantities, with a resulting imbalance between nitrogen and phosphate use. While the recommended ratio is close to 1:1 for most crops, Pakistan's ratio is at best 3:1. Despite the fact that the import of phosphate is late year after year, the government seems unable to respond to the problem.

Fertilizer policy is imposing large hidden costs on farmers, including search costs for scarce supplies, uncertainty about availability leading to panic buying, and depressed yields through lack of availability at the required time.

The benefit of a liberalized input market is evident from the extraordinary growth in pesticide use after the subsidy was ended and entry to the market was liberalized. Indeed, widespread pesticide use is widely held to explain the dramatic growth in cotton yields in the 1980s.

Use of improved seed has been held back by problems of availability, accessibility, and quality. On-farm research has estimated that use of old varieties of seed could be depressing yields by 15 percent. As in fertilizer, government policy is causing distortions. Private seed firms have to compete with a large public sector producer which prices uneconomically and runs losses. Private seed development is also held back by non-existence of breeders' rights and lack of trademark protection. Enforcement of laws regarding seed quality is lax. Little work is now being done to develop seeds for fodder crops and high value food crops.

Mechanization

⁷ These figures represent gross deadweight losses. Net deadweight losses (which take account of the withdrawal of resources from other sectors) would be less.

We established earlier that the distribution of land is highly unequal in Pakistan and that tenancy has been in steep decline. Past attempts at land reform have not been successful. These trends have been facilitated by machinery prices.

A World Bank comparison of tractor prices in 16 countries in 1985 found that Pakistan and Turkey had the cheapest tractors in the world (in US dollars, at exchange rates used in import transactions). The price per horsepower was \$136 in Pakistan, compared with just over \$175 in India and Brazil, \$200 in Indonesia and Sudan, \$212 in Mexico and Egypt, and over \$300 in Sub-Saharan Africa. This is partly because tractors imported into the country as completely knocked down kits were subject to relatively low import charges of 10 percent, and are assembled in a competitive industry.

However, unequal access to credit and mechanization subsidies could mean that the benefits of low tractor prices are not widely distributed. Interest rates on machinery remain significantly lower than parity interest rates: up to 40 percent lower in 1991. While Longmire and Debord show that tractor prices have been slightly above world prices in recent years, it is possible that other countries have decided that even higher tractor prices were desirable to avoid undue increases in farm size and displacement of tenants.

Research from Pakistan and elsewhere has shown that mechanization has far greater labor-displacing than output enhancing effects. Policy induced lowering of tractor prices led to premature tractorization and labor displacement. While any distortion in factor prices should be avoided, a cheap tractors policy is particularly undesirable for a country such as Pakistan. An economy with abundant rural labor should not have a policy mix that discourages rural employment. Agriculture cannot absorb the entire rural labor force, and some migration is inevitable. However, there are considerable advantages to ensuring that rural urban migration takes place at a controlled rate, and that cities are not overwhelmed by a flood of displaced labor from rural areas.

Some mechanization of Pakistani agriculture was clearly inevitable. Mechanized power reduces the burden of agricultural labor, and when capital intensity is low (as in Pakistan before the Green Revolution), the productivity gains from mechanization are considerable. In addition, the emergence of lucrative work opportunities in Middle Eastern oil markets in the 1970s represented a huge exogenous shock to the Pakistani labor market that lowered rural labor supply, necessitating labor-saving investments. Finally, the intensification in input use that followed the Green Revolution was bound to lead to a rise in complementary inputs, including machinery. However, the rise in mechanization has been particularly rapid (Table 9), relative to the growth of other inputs.

Of course, this alone is not sufficient to establish that mechanization was excessive. Further insight can be gained through production function analysis. This allows us to isolate the productivity contribution of different inputs. Ali and Velasco use time series and district data on different cropping systems to estimate production functions for Pakistani agriculture. Estimates are presented separately for the 1970s and 1980s. (Table 10)

**Table 9: Intensification in the Crop Sector
Annual Trend Rates of Growth.**

Inputs	1970-79	1980-89
Cropping Intensity (%)	1.1	1.1
Fertilizer (Kg/Ha)	12.4	6.6
Water (000 cubic feet/ha)	1.9	1.9
Tractor (number/1000 ha)	15.1	10.1
Labor (labor days/ha)	1.3	1.9

Source: Ali and Velasco (1993).

**Table 10: Input Production Elasticities in the Crop Production sector
in Pakistan, 1970-79 and 1980-89.**

Input	Labor		Power	
	1970-79	1980-89	1970-79	1980-89
Cropping System				
Wheat-Cotton	-0.24	1.06	0.55	0.39
Wheat-Rice	1.17	1.40	-0.53	-0.24
Wheat-Mixed	0.18	1.41	0.78	-0.39
Punjab and Sind	0.15	0.83	0.64	-0.06

Source: Ali and Velasco, Table 8. Generalized Least Squares estimates. Input production elasticities are calculated at mean values.

Power includes bullock and mechanical power but mechanical power is the dominant component in this category. Note how the input elasticities for labor rise between the 1970s and 1980s, while those of power fall. This indicates an increasing marginal productivity of labor over time, brought about by capital deepening in agriculture, to the point where further increments of mechanical power cease to be productive. Some of this can be explained by the tightening of rural labor markets and indeed agricultural wages have increased dramatically. However, given the incentives to mechanize resulting from subsidies and the threat of land reforms, it is a safe conjecture that the capital labor ratio in agriculture is higher than it would have been in the presence of undistorted factor prices.

The increase in labor's elasticity came against a background of declining elasticities for the other inputs (fertilizer, seed, pesticide, and water). As noted earlier, Ali and Velasco attribute the general decline in the productivity of inputs to resource degradation. Total factor productivity also stagnated or declined in the major cropping systems in the 1970s and 1980s. It

thus appears that mechanization did not contribute to any major increase in output or technological progress in agriculture. Resources that were directed towards mechanization may have been better spent in maintaining the resource base. Labor was displaced by mechanization, without a rise in the productivity of any other inputs. Pakistan's cheap tractors policy therefore cannot be judged a success. The continuation of past policies in this area will supply exacerbate these problems.

Institutions

From a sustainability perspective, the most important institutions are those which focus on the knowledge of farmers research and extension. Crop management research emphasizes increases in productivity through research on such issues as timing and method of application of input rather than type of input, and land preparation and harvesting. Resource management research focuses on preservation of the natural resource base. For most crops in Pakistan, it is difficult to find good examples of Crop and Research Management Research which have been translated to farmers' fields. Much evidence indicates that key inputs such as water and fertilizer are inefficiently used.

Existing research has failed to increase input efficiency. Outcomes from well-controlled experiments need to be better tailored to farmer conditions. Issuing technical packages to large, heterogeneous groups of farmers is not enough and they have to be given the means to adapt these packages to their own circumstances. Crop and resource management research lacks a systems perspective. Specialized research tends to ignore interactions between different crops and different agronomic issues. Key long-term issues such as necessary natural resource investments are generally ignored.

Extension: Most studies indicate that the variables that consistently explain farmer inefficiency are farmers' knowledge and skills. As emphasis switches from input intensification to input efficiency, improvements in information and skills play a bigger role in increasing productivity. The information burden on farmers will only increase as agriculture becomes more commercialized and sustainability issues come to the fore. Extension thus has a central role in improving productivity growth, and also in making the distribution of benefits from knowledge more equitable. Small farmers may find it more expensive to acquire knowledge, and so public extension has a role in equalizing access to new methods.

Extension programs take most of the current agricultural budget of the government but their impact is negligible. An elaborate extension system is already in place for crops, but many farmers question its usefulness. There are now over 5,000 village extension workers (EWs) but they often lack adequate training, which makes their task of improving the management skills of farmers very difficult. Extension workers with higher education and communication skills are often likely to be assigned administrative responsibilities. The system is characterized by a one-way transfer of technology to a few inadequately selected farmers. Women and small farmers

are often ignored. Feedback from farmers is poor. Organizational problems are severe (especially lack of accountability), and operational funding for extension workers is low.

Much effort was made in the 1980s to implement the training and visit extension system (T&V). It appears that the system had only modest success. Measures of farmer contact do show an increase, and extension services may have had impact on increasing pesticide use. However, Husain et al (1994) could find little evidence that T&V had improved the quality of extension advice. An increase in extension contact does not necessarily show that extension has aided growth. In addition, contact is highly skewed towards large farmers. A survey of extension contact in Punjab in 1986⁸ showed that 60 percent of farmers with over 10 hectares of land had contact with the extension service in the previous year, whereas only 24 percent of farmers with 5 to 10 hectares had contact over the same period.

IV. Future Outlook: How to sustain or even improve past growth in agriculture?

As noted, the past growth rate can not be sustained without substantial increase in the overall productivity of the sector and increase in productivity will require major changes in systems and policies for agriculture. What are those needed changes? This is the fundamental question facing Pakistani policy makers in agriculture. Answering them will mean first defining the appropriate role for government -- to encourage the development of a smoothly functioning market, through institutional and regulatory reforms that facilitate private sector activities and market efficiency. Where market failure is not an issue, and government inefficiency is clearly evident, the strategy will require that government's role must be reduced. Investment and public expenditure on agriculture will need to be reshaped. Government spending needs to focus on public goods and market failures, and not on activities better suited to the private sector. In poverty and the environment, the government will have an active role.

Needed Reforms

Price and Trade Policy: In keeping with structural reforms, output prices should be market determined, so market signals will be transmitted to farmers with least distortion. The best option for the government is to remove price supports and controls, because these distort market signals and have huge fiscal costs. Such liberalization will generally improve production incentives for crops in which Pakistan has a comparative advantage. The government aim of reducing inter- and intra- year price fluctuations can be achieved by other more cost effective means, such as promoting on-farm storage, private-sector storage, and futures trading. The government will need to consider ending the subsidy on wheat imports. Since the price of flour is already market-determined and close to import parity, this will have little effect on consumers, but producers may get prices close to import parity. The government will need to ensure that there are no import restrictions on wheat and flour. It would be desirable to remove protection of

⁸ Byerlee (1994).

sugarcane through high support prices and sugar import restrictions, allowing diversion of scarce resources (such as water and land) to more efficient uses.

Trade reform will have to be completed speedily. In general, the government may not disprotect products in which Pakistan has a comparative advantage, while those in which it has no comparative advantage should not have protection. In particular, taxes on cotton exports, duties on sugar imports, and quantitative restrictions on both will have to be removed; any loss of revenue would be offset by removing the wheat subsidy. The terms of trade for agriculture will have to be corrected by lowering industrial protection. East Asian countries have benefited from having a much smaller bias against agriculture in their trade policies. Rather than aim at self-sufficiency in industry, it is better to direct resources to their most efficient use. The combined effect of price and trade reform will be to improve the allocation of resources and the profitability of agriculture. It is essential to generate increased incomes in agriculture to support investment in the sector-including investments in resource conservation which is often privately profitable.

The government will need to halt the sort of micro-management that can be better undertaken by the private sector. Importation of fertilizer is a prime example. There is also no need for government presence in the marketing of improved (certified) seed.

Irrigation should undergo a demand-based decentralization, through the development of water user associations (WUAs) at distributary level. These WUAs would be participatory farmer organizations that will assume responsibility for downstream operations and maintenance of irrigation systems. Upstream at canal command would be the responsibility of commercially oriented public utilities (PUs), and explicit contractual obligations would exist between the PUs and the WUAs. At provincial level, autonomous water authorities would be responsible for major provincial storages, link canals, off-farm and provincial drains, and flood control and management.

Irrigation charges can be raised to reflect the cost of provision, the quality of service provided, and the cost of competing alternatives. Disputes between the different groups in the irrigation system will be resolved by powerful regulatory authorities, free from political influence. A legal and institutional framework for the market exchange of water rights will also be established. Off-farm drainage, a public good, will continue to be the responsibility of government. Costs of drainage can be recovered from farmers.

These reforms will increase the efficiency of water use, ensure that the cost of water truly reflects its economic cost, reduce waterlogging and salinity problems, and will allow water to go to its most efficient user via the sale of water rights.

Land reform is a long-term project which will require careful consideration. However, some immediate measures would be highly desirable to correct land market distortions, which include low machinery prices (often effectively zero through the use of delinquent loans to buy machinery), and unequal access to credit (which makes it difficult for small farmers to expand

their holdings). These reforms would increase opportunities available for farming, and for wage labor on employment-intensive farms. The land title process can be modernized and streamlined, including the establishment of a system of permanent title deeds to land. Security of tenure shall be assured, without creating further disincentives to rent-out land. This would facilitate long-term (especially natural resource management) investments. The minimal goal Of land market reforms must be to ensure that land is operated and managed by the most efficient user. A prerequisite for this is full economic pricing of water & mechanized inputs. With water charges currently so low, there is little incentive to use the water rights, attached to land in efficient fashion. When these reforms are coupled with ending the use of land as a tax shelter and credit vehicle, the efficiency of land allocation will greatly improve.

It will be desirable to end directed credit in any form. Groups finding it hard to gain access to credit could perhaps be helped by a scheme to underwrite the setup costs of credit. Such assistance would be one-time and reduce the transaction costs, and the best option is not to have any recurrent subsidy. It is necessary to ensure high loan repayment rates to ensure sustainability and any such scheme should not interfere with liberalization of interest rates. The government will need to consider developing an institutional and legal framework to allow efficient lending to agriculture, unhindered by highly restrictive collateral requirements and seasonal credit regulations. As we have emphasized, credit reforms are essential to increase investment in the sector.

Institutional Reforms: Most of Pakistan's agriculture has entered a post-green revolution stage of development that requires new strategies to enhance input efficiency and maintain and improve the quality of the resource base. By most measures of productivity, Pakistan's institutions have not evolved to meet this challenge. Reform in public spending is central to these needed institutional improvements.

Support for research should continue, but expenditure needs to be restructured so that salaries do not soak up most of the available funds. Research institutions will be made more autonomous, salary restrictions lifted, and other funding sources mobilized. Training of research professionals will include an understanding of the problems of farming systems, including irrigated agriculture. Greater importance should be attached to research in cropping systems. For instance, it now appears that wheat fields are a breeding ground for pests that attack the cotton crop, calling into question the viability of the cotton-wheat system. Thus, research needs to focus on solutions to such problems by focusing on sustainable farming systems. Publicly funded research will stress growth-enhancing public goods, environmental impact, and poverty reduction.

Research which can profitably be financed by the private sector, need not be underwritten by the limited public budget. Joint public-private funding of research is also desirable. Private and public sector research financing could, where possible, be on a competitive basis, meaning that funding to institutions would be on the basis of performance. Monitoring of research needs to improve, though this will have to be consistent with greater decentralization. Coordination between different research institutions will have to be improved, and unnecessary duplication

avoided. Producers, NGOs, and other participants from the private sector should be encouraged to take part in setting research priorities. Transfer of technology will be an integral part of the mandate of research institutions. Coordination between provincial research agencies will have to be encouraged.

Both productivity and sustainability can be enhanced by improvements in crop and resource-management research. Greater attention to local conditions can be achieved by defining major agro-ecological zones and subsystems in these zones. These zones and systems, rather than political boundaries, would then be the basis for organizing crop and resource-management research. Research should be directed at monitoring changes in the resource base at the farm level. There is a special need for improvements in the major cropping systems, overcoming problems such as delayed planting, and depletion of soil organic matter. Adaptive research (which would be a part of the extension service, outlined next) would provide site- and season-specific recommendations and information to adapt them to each farmer's needs. Incentives could be provided for greater participation of farmers in defining research priorities.

With no-one happy with the performance of the extension service, major reform of the service is a top priority. The traditional purpose of extension as the disseminator of new technology needs to be rethought. In the early green revolution stage there was an advantage to speeding the diffusion of the HYV seed and fertilizer package to farmers. However, with HYVs now widely diffused, it is hard to believe that there is a technological package that would be profitable for farmers, but has not already been implemented by them.

The notion of extension as a top-down supply-driven process needs to be revised. The goal should instead be to create a demand for information amongst farmers, a demand which could then be satisfied by extension workers. The service should concentrate more on participatory problem solving with farmers at the local level, which means substantially improving education levels of farmers and extension workers.

The extension service may have to be reduced in size. The cadre of extension agents at Union Council level may have to be gradually scaled down. Instead of too many extension agents with too little training, there will be fewer, better qualified agents. It would be desirable for extension to be extended to cover women farmers. Additional public funding should be contingent on an improvement in organizational capability.

Some extension is already being undertaken by the private sector companies. These and NGOs could be encouraged to increase the provision of extension services. A system of advisory services by adaptive research institutions to medium and large farmers on payment of fees could be encouraged.

Operational management of extension services needs to be decentralized, and farmers should play a bigger part in control and evaluation of these services. Extension services will have to be geared to problems of all farming systems (including livestock, forestry, and water management) and not just major crops. It will be desirable to have a more diversified approach to

extension -- one that responds to varying needs of farmers, and uses various available sources of extension services, including the private sector.

The "contact farmer" approach to extension will have to be reconsidered. A group approach to message delivery would be broadly based, it would also complement groups in other areas, notably in water and credit provision. Such a system would rely more on audio-visual means, extensive on-farm demonstrations, and farm fairs.

Both research and extension need to focus more on the problems of small resource-poor producers. Greater investment in formal schooling will also be critical in raising technical efficiency and productivity. Education raises a person's ability to acquire and process information, and to respond to changes in the environment. Increased training will also prepare farmers for the increased organizational burden which will be placed on them through the formation of water-user associations and other user groups.

The government's role in rural infrastructure provision needs to be strengthened. Increased revenue from the tax reforms and savings from the rationalization of public expenditures on agriculture could be used to finance road work. Farm to village roads would improve the distribution of inputs and marketability of outputs. The transition to high value (often perishable) foods, would be greatly facilitated by better roads.

More emphasis on natural resource management problems in agriculture is required. Policy interventions for natural resource management and the environment will be based on three principles (a) Price adjustments for scarce natural resources in order to provide appropriate conservation incentives (b) identifying regulatory mechanisms which could be effective in addressing market failure, bearing in mind the poor record of existing regulatory agencies and (c), restructuring public expenditures to focus on natural resource management priorities.

The government needs to phase out policies that give the wrong signals to private agents for use of natural resources. Water pricing should be resolved as part of the overall reform of the irrigation sector. Factor price distortions that lead to labor displacement can increase environmental stress (farming on marginal land or rural-urban migration). It will be helpful to remove such distortions.

In environment and natural resource management, market failure is more likely to be a problem. Many market failures, such as the excessive application of harmful pesticides, will require public regulation. Increased pesticide use has created growing resistance among pests, and destroyed natural predators. Integrated pest management would be more effective and environmentally friendly, as well as consistent with the demands of Pakistan's export markets. An effective institutional mechanism for transmitting knowledge about Integrated pest management is essential. There may be a case for linking subsidies to activities with positive externalities, such as soil conservation techniques.

Lack of property rights and institutions to manage common property resources can inflict on-site damage and create negative externalities. Successful watershed management projects need to be extended. Project design should be sensitive to the creation of community

management institutions to address common property resource management problems. Interventions should take the form of providing incentives for the adoption of sustainable resource management techniques. New technologies which can enhance the physical status of common property resources should be encouraged.

To conclude there is an essential complementarity between the proposed reforms. Price and trade reform will allow farmers to produce the optimal output and raise income in agriculture. This will allow increased investment in agriculture; but it is essential that farmers have the appropriate incentives and institutional framework to make these investments. This requires well functioning markets in land and water, and an enhanced knowledge base so that farmers can make appropriate management and investment decisions. The gains from increased efficiency and an improved pattern of investment in agriculture represent the dominant source of growth in agriculture in the future, now that the sources of growth in the past have weakened considerably.

Bibliography

Ahmed, Sadiq 1994. "Explaining Pakistan's High Corrupt Performance Over the Past Two Decades, Can it be Sustained?" Policy Research Working Paper 1341 World Bank

Ali, Mubarak, and John C. Flinn, 1989. "Profit Efficiency Among Basmati Rice Producers in Pakistan Punjab", American Journal of Agricultural Economics, May, pp 303-310

Ali, Mubarak, and Derek Byerlee, 1991. "Economic Efficiency of Small Farmers in a Changing World: A Survey of Recent Evidence", Journal of International Development, Vol. 3, No. 1, pp 1-27

Ali, Mubarak, and Lourdes E. Velasco, 1993. "Intensification Induced Resource Degradation: The Crop Production Sector in Pakistan", International Rice Research Institute, Social Sciences Division.

Binswanger, Hans and Gershon Feder, 1993. "Power, Distortions, Revolt, and Reform in Agricultural Land Relations". World Bank Policy Research Working Paper.

Byerlee, Derek, 1994. "Agricultural Productivity in Pakistan: Problems and Potential", prepared for World Bank Agricultural Sector Review.

John Mellor Associates, 1994. "Priority Institutional Reforms to Accelerate Growth in Irrigated Agriculture", with Asianincs Agro-DEv International.

Gulati, Ashok, and Garry Pursell, 1993. "Liberalizing Indian Agriculture: An Agenda for Reform". World Bank Policy Research Working Paper WPS 1172.

Hamid, Naved, Ijaz Nabi and Anjum Nasim, 1990. "Trade, Exchange Rate, and Agricultural Pricing Policies in Pakistan". World Bank.

Husain, Tariq, et al, 1992. Pakistan Study of the Structure of Rural Land and Labor Markets, Final Report, submitted to USAID/Pakistan, EDC (Pvt) Limited.

Ilahi, Nadeem, 1994. "Agriculture, The Rural Economy, and Poverty in Pakistan", prepared for World Bank Agricultural Sector Review.

Krueger, Ann O., Maurice Schiff, and Alberto Valdes, 1988. "Agricultural Incentives in Developing Countries: Measuring the Effect of Sectoral and Economywide Policies". World Bank Economic Review, Vol.2, No. 3, 255-271.

Mahmood, Moazam, 1994. "A Macro Analysis of Time Change in the Distribution of Agricultural Land in Pakistan", prepared for World Bank Agricultural Sector Review.

Malik, Sohail, 1991. "Poverty in Pakistan: 1984-85 to 1987-88", International Food Policy Research Institute Working Paper.

Malik, Sohail, 1993. "Credit Constraints and Household Borrowing Behaviour: Impact on Household Consumption and Fertilizer Use in Selected Areas of Rural Pakistan", Working Paper, International Food Policy Research Institute, Washington D.C.

Malik, Sohail, 1991. "Report on the Benchmark Rural Credit Survey 1990", International Food Policy Research Institute Working Paper.

Noman, Omar, 1994. "Sustainable Development: What does it mean, and how can it be implemented?", prepared for World Bank Agricultural Sector Review.

Rosegrant, Mark W., and Robert Evenson, 1993. "Agricultural Productivity Growth in Pakistan and India: A Comparative Analysis", presented at Pakistan Institute of Development Economists Ninth A.G.M.

Saleemi, A.R., 1994. "Agronomy, Crop Production, and Sources of Productivity", prepared for World Bank Agricultural Sector Review.

Shabbir, Tayyeb, 1994. "Agricultural Prices in Pakistan", prepared for World Bank Agricultural Sector Review.

Valdes, Alberto, 1994. "Mix and Sequencing of Economy-wide and Agricultural Reforms: Some Lessons of Experience from Early Reformers", presented at Agricultural Symposium, The World Bank, January 5-6.

World Bank, 1993. The East Asian Miracle: Economic Growth and Public Policy, Policy Research Report.

World Bank, 1994. "Pakistan Irrigation and Drainage: Issues and Options". Agricultural Operations Division, South Asia Region.

World Bank, 1994. "Pakistan: A Strategy for Sustainable Agricultural Growth". Agricultural and Natural Resources Division, South Asia Region.

Policy Research Working Paper Series

	Title	Author	Date	Contact for paper
WPS1384	Fiscal Decentralization and Intergovernmental Finances in the Republic of Albania	David Sewell Christine I. Wallich	November 1994	G. Langton 38392
WPS1385	Fiscal Federalism Dimensions of Tax Reform in Developing Countries	Robin Boadway Sandra Roberts Anwar Shah	November 1994	C. Jones 37754
WPS1386	EU Bananarama III	Brent Borrell	December 1994	G. Ilogon 33732
WPS1387	Fiscal Decentralization and the Size of Government: An Extension with Evidence from Cross-Country Data	Jaber Ehdaie	December 1994	C. Jones 37699
WPS1388	Does Voice Matter? For Public Accountability, Yes	Samuel Paul	December 1994	B. Moore 35261
WPS1389	Ruble Overhang and Ruble Shortage: Were They the Same Thing?	Patrick Conway	December 1994	L. Suki 33974
WPS1390	Regional Integration and the Baltics: Which Way?	Piritta Sorsa	December 1994	J. Ngaine 37947
WPS1391	Where in the World Is Population Growth Bad?	Jeff Kling Lant Pritchett	December 1994	S. Fallon 38009
WPS1392	Some Economic Consequences of the Transition from Civil War to Peace	Jean-Paul Azam David Bevan Paul Collier Stefan Dercon Jan Gunning Sanjay Pradhan	December 1994	C. Jones 37699
WPS1393	The Interface of Trade, Investment, and Competition Policies: Issues and Challenges for Latin America	J. Luis Guasch Sarath Rajapatirana	December 1994	J. Troncoso 37826
WPS1394	Macroeconomic Reform and Growth in Africa: <i>Adjustment in Africa</i> Revisited	Lawrence Bouton Christine Jones Miguel Kiguel	December 1994	R. Martin 39026
WPS1395	A Typology of Foreign Exchange Auction Markets in Sub-Saharan Africa	Janine Aron Ibrahim Elbadawi	December 1994	R. Luz 39059
WPS1396	Foreign Exchange Auction Markets In Sub-Saharan Africa: Dynamic Models for Auction Exchange Rates	Janine Aron Ibrahim Elbadawi	December 1994	R. Luz 39059

Policy Research Working Paper Series

Title	Author	Date	Contact for paper
WPS1397 Are Private Capital Flows to Developing Countries Sustainable?	Uri Dadush Ashok Dhareshwar Ron Johannes	December 1994	J. Queen 33740
WPS1398 The Cost of Air Pollution Abatement	Raymond S. Hartman David Wheeler Manjula Singh	December 1994	E. Schaper 33457
WPS1399 How Important to India's Poor is the Urban-Rural Composition of Growth?	Martin Ravallion Gaurav Datt	December 1994	P. Cook 33902
WPS1400 Technical and Marketing Support Systems for Successful Small and Medium-Size Enterprises in Four Countries	Brian Levy with Albert Berry, Motoshige Itoh, Linsu Kim, Jeffrey Nugent, and Shujiro Urata	December 1994	D. Evans 38526
WPS1401 Colombia's Small and Medium-Size Exporters and Their Support Systems	Albert Berry Jose Escandon	December 1994	D. Evans 38526
WPS1402 Indonesia's Small and Medium-Size Exporters and Their Support Systems	Albert Berry Brian Levy	December 1994	D. Evans 38526
WPS1403 Small and Medium-Size Enterprise Support Policies in Japan	Motoshige Itoh Shujiro Urata	December 1994	D. Evans 38526
WPS1404 The Republic of Korea's Small and Medium-Size Enterprises and Their Support Systems	Linsu Kim Jeffrey B. Nugent	December 1994	D. Evans 38526
WPS1405 Growth and Poverty in Rural India	Martin Ravallion Gaurav Datt	January 1995	WDR 31393
WPS1406 Structural Breaks and Long-Run Trends in Commodity Prices	Javier León Raimundo Soto	January 1995	R. Luz 31320
WPS1407 Pakistan's Agriculture Sector: Is 3 to 4 Percent Annual Growth Sustainable?	Rashid Faruquee	January 1995	F. Willie 82262